

REMARKS

The Office Action mailed on March 21, 2001, has been received and reviewed. Claims 1-38 are currently pending in the application. Claims 1-38 stand rejected. Reconsideration of the referenced application is respectfully requested.

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 19 and 38 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The term "desired" has been removed from both claim 19 and claim 38 and replaced with the more definite term "particular". It is respectfully submitted that the term "particular", as used in claims 19 and 38 is clearly useful in defining the metes and bounds of claims 19 and 38, both of which recite that the relative concentrations of a component and primary etchant in a combination are tailored to provide particular etch selectivities, as well as a particular etch rate. It is further submitted that the mere fact that different etch selectivities and etch rates may be achieved by varying the concentrations of the primary etchant and the other component of the combination does not make the metes and bounds of either claim 19 or claim 38 unclear.

It is, therefore, respectfully requested that the 35 U.S.C. § 112, second paragraph, rejections of claims 19 and 38 be withdrawn.

Rejections Under 35 U.S.C. § 103(a)

Ding in View of Bosch

Claims 1-38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,814,563 to Ding et al. (hereinafter "Ding") in view of U.S. Patent 5,626,716 to Bosch et al. (hereinafter "Bosch").

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the

art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Ding teaches, among other things, a dry etchant chemical combination that includes a fluorocarbon gas, an ammonia (NH_3) generating gas, and a carbon-oxygen gas. The dry etchant chemical combination of Ding is useful for patterning or removing dielectric materials, such as doped and undoped silicon oxides. Among the various fluorocarbons that are specifically disclosed in Ding as being useful in the dry etchant chemical combination are CHF_3 and $\text{C}_2\text{H}_4\text{F}_2$. Ding also provides that the dry etchant chemical combination etches dielectric materials with selectivity over both photoresist materials and polysilicon. Ding does not, however, disclose, teach, or suggest that any dry etchant chemical combination that includes $\text{C}_2\text{H}_4\text{F}_2$ may be used to dry etch doped silicon oxide with selectivity over undoped silicon oxide.

Bosch teaches a dry etchant chemical combination that includes CHF_3 (Freon-23) and neon (Ne) that is formulated to remove doped silicon oxides with selectivity over undoped silicon oxides, silicon nitride, silicides, silicon. Accordingly, any of these materials may be used as an etch stop when a doped silicon oxide is being dry-etched with the disclosed combination of CHF_3 and Ne. Bosch does not disclose, teach, or suggest any dry etchant chemical combination that includes $\text{C}_2\text{H}_x\text{F}_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$. Nor does Bosch disclose, teach or suggest that any such dry etchant chemical combination may be used to dry etch doped silicon oxide, let alone to dry etch doped silicon oxide with selectivity over undoped silicon oxide.

It is respectfully submitted that, under 35 U.S.C. § 103(a), each of claims 1-38 is allowable over the combination of Ding and Bosch for at least two reasons.

*One of Ordinary Skill in the Art Would Not Have Been Motivated to Make
the Proposed Combination*

First, it is respectfully submitted that, based solely on the teachings of Bosch, Ding, and the knowledge that was generally available to those of skill in the art at the priority date for the referenced application, one of ordinary skill in the art would not have been motivated to use an etchant comprising $C_2H_xF_y$, where x is an integer from three to five, inclusive, y is an integer from one to three, inclusive, and $x + y = 6$, as a component of a dry etchant that is formulated to etch doped silicon dioxide with selectivity over at least undoped silicon oxide.

M.P.E.P. § 2142 provides:

The initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done. 'To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or **the examiner must present a convincing line of reasoning** as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references,' *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985) (Emphasis supplied). . .

Thus, the Office's burden of setting forth a *prima facie* case of obviousness is substantial.

M.P.E.P. § 2142 further provides:

When the motivation to combine the teachings of the references is not immediately apparent, **it is the duty of the examiner to explain why the combination of teachings is proper.** *Ex parte Skinner*, 2 USPQ2d 1788 (Bd. Pat. App. & Inter. 1986).

It is respectfully submitted that, despite the directive to provide a convincing line of reasoning, no such reasoning has been provided to support the assertion that one of ordinary skill in the art would have been motivated by Ding, Bosch, or the teachings that were generally available in the art before the priority date for the referenced application to combine the teachings of Ding and Bosch in the manner asserted in the outstanding Office Action. Rather, page 3 of the Office Action boldly states that "Bosch is not particular about the etchant to be used in the dry etching process, therefore, *any conventional etchant* (e.g., fluorohydrocarbon) *will be formulated and inherently contain the same properties.*" (Emphasis supplied). If it is

true that *any* conventional etchant could meet the limitations of the claims of the referenced application, some evidence other than Bosch must be available. Nonetheless, no such evidence has yet been provided. The Office is respectfully requested to provide some evidence that *any* conventional etchant could meet the limitations of the claims if that assertion is actually true.

It is also respectfully submitted that the assertion that *any* conventional etchant could meet the limitations of the pending claims does not itself qualify as an explanation of why the combination of Ding and Bosch is proper. Again, such an explanation should be based on some evidence in support of the assertion that "*any* conventional etchant . . . [may] be formulated and inherently contain the same properties" as CHF_3 , the sole selective etchant discussed in Bosch.

Further, it is submitted that the mere assertion that "both CHF_3 and any $\text{C}_2\text{H}_x\text{F}_y$ are from the same class of compounds, they are all fluorohydrocarbon gas" does not comprise a clear line of reasoning and, therefore, is not sufficient to have motivated one of ordinary skill in the art to combine the teachings of Ding and Bosch to come up with the presently claimed dry etchants. To the contrary, it is well known in the art that different members of general groups of compounds may have very different properties.

The group of fluorohydrocarbon gases is a very large group of various chemical genuses and species and, by name, indicates that the members thereof need only include carbon atoms, fluorine atoms, and hydrogen atoms. The broad group of fluorohydrocarbon gases includes smaller genuses, or subgroups, including fluoromethanes and fluoroethanes. CHF_3 is a member of the fluoromethane group, while the $\text{C}_2\text{F}_x\text{H}_y$'s with $x + y = 6$ are each members of the heavier, fluoroethane group.

The utility of CHF_3 , a fluoromethane, is well known in the art to be useful with other components of a dry etchant chemical combination to etch doped silicon oxide with some selectivity over undoped silicon oxide. No support, however, has been provided for the assertion that any $\text{C}_2\text{F}_x\text{H}_y$, where x is an integer from three to five, y is an integer from one to three, and $x + y = 6$, or fluoroethane, may be used as a dry etchant or in a dry etchant chemical combination that etches doped silicon dioxide with selectivity over undoped silicon oxide. Nor

has any support been provided that $C_2F_4H_2$ of the type recited in the pending claims would even be useful as a dry etchant for doped silicon oxide.

There are several additional reasons that one of ordinary skill in the art would not have been motivated to replace the CHF_3 of Bosch's CHF_3 -Neon etchant system with the $C_2H_4F_2$ of Ding to create a dry etchant that would remove doped silicon dioxide with selectivity over at least undoped silicon dioxide. First, the etchant system disclosed in Bosch purportedly achieved the desired result: etching doped silicon oxides with selectivity over undoped silicon oxides, so there would be no motivation to modify the system as disclosed. Second, the selectivities of the etchant systems that are respectively disclosed in Bosch and Ding are very different. While Bosch teaches an etchant system that is useful for dry etching doped silicon oxides with selectivity over undoped silicon dioxides, Ding discloses etchant systems that are useful for etching dielectric materials, including both doped and undoped silicon oxides, with selectivity over photoresist materials and over polysilicon. Third, the etchant systems of both Bosch and Ding require the use of additional components, none of which are common to both references. Nonetheless, Bosch teaches that the use of neon along with CHF_3 provides the desired selectivity for doped silicon oxides over undoped silicon oxides and other materials, *see* Bosch, col. 2, lines 34-44, while Ding teaches that the use of a dry etchant system including one of the listed fluorocarbons (e.g., CHF_3 or $C_2H_4F_2$), an ammonia-generating gas, and a carbon-oxygen gas is useful for etching dielectric materials, including both doped and undoped silicon oxides, with selectivity over photoresist materials and polysilicon.

The disclosed use of CHF_3 as a possible component of both the etchant system of Ding and the etchant system of Bosch does not provide the motivation to combine the teachings of Ding and Bosch in the manner that has been suggested in the outstanding Office Action. In fact, Bosch itself warns against reading any such motivation into the references by providing, at col. 1, line 57, to col. 2, line 5, that, although many different gaseous media have been used in dry etching, successful use of etchants or etchant combinations to achieve a desired result often depends on chance due to the number of variables involved, including the materials to be etched, the selectivity, and the degree of anisotropy.

For these reasons, it is respectfully submitted that one of ordinary skill would not have been motivated by the teachings of either Bosch or Ding, or by the knowledge generally available to those of ordinary skill in the art before the priority date of the referenced application, to replace CHF_3 , a component of an etchant system that was known to provide the desired selectivity result, with $\text{C}_2\text{H}_4\text{F}_2$, a different chemical that had previously been used in a system which did not provide the desired etchant selectivity for doped silicon oxides over undoped silicon oxides.

There Is No Reasonable Expectation that the Proposed Combination Would Be Successful

Second, it is respectfully submitted that there is no reasonable expectation that the combination of Ding and Bosch would be successful.

In particular, for the reasons provided above, no support has been provided to demonstrate that $\text{C}_2\text{F}_x\text{H}_y$, where x is an integer from three to five, y is an integer from one to three, and $x + y = 6$, or fluoroethane, would be useful as either a dry etchant or in a dry etchant chemical combination to etch doped silicon dioxide, let alone to etch doped silicon dioxide with selectivity over undoped silicon oxide. Thus, there is no basis for one of ordinary skill in the art to reasonably expect that a dry etchant including the $\text{C}_2\text{H}_4\text{F}_2$ of Ding could be formulated to etch doped silicon dioxide with selectivity over at least undoped silicon dioxide.

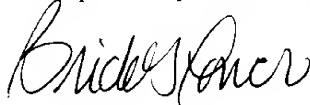
Moreover, as indicated at col. 1, line 57, to col. 2, line 5, of Bosch, the successful use of etchants or etchant combinations to achieve a desired result—in this case the ability to etch doped silicon dioxide with selectivity over at least undoped silicon dioxide—depends on chance. As M.P.E.P. § 2141.02 requires that each prior art reference used in a claim rejection must be considered in its entirety, it is respectfully submitted that the Bosch's indication of the chance involved must be read as indicating that one of ordinary skill in the art could not reasonably expect that a dry etchant including the $\text{C}_2\text{H}_4\text{F}_2$ of Ding in place of the CHF_3 of Bosch to etch doped silicon dioxide with selectivity over at least undoped silicon dioxide.

In view of the foregoing, it is respectfully submitted a *prima facie* case that the teachings of Ding and Bosch could be combined under 35 U.S.C. § 103(a) to render obvious the subject matter recited in any of claims 1-38 has not been set forth. It is, therefore, submitted that each of claims 1-38 is allowable under 35 U.S.C. § 103(a). Accordingly, withdrawal of the 35 U.S.C. § 103(a) rejection of claims 1-38 is respectfully requested.

CONCLUSION

Claims 1-38 are believed to be allowable. An early indication of the allowability of each of these claims is respectfully solicited, as is an indication that the case has been passed for issuance. If any issues preventing the allowance of any of claims 1-38 remain that might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully Submitted,



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Enclosure: Version With Markings to Show Changes Made

N: 2269 3526 4 Amendment wpd

**VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE CLAIMS:**

19. (Amended) The dry etchant of claim 3, wherein relative concentrations of said component and said primary etchant in said combination are tailored to provide for at least one of a [desired] particular etch selectivity of doped silicon dioxide over undoped silicon dioxide, a [desired] particular etch selectivity of doped silicon dioxide over silicon nitride, and a [desired] particular etch rate of doped silicon dioxide.

38. (Amended) The dry etchant of claim 22, wherein relative concentrations of said component and said primary etchant in said combination are tailored to provide for at least one of a [desired] particular etch selectivity of doped silicon dioxide over undoped silicon dioxide, a [desired] particular etch selectivity of doped silicon dioxide over silicon nitride, and a [desired] particular etch rate of doped silicon dioxide.